PARISHRAM 2024

- FOR 12TH CLASS CBSE BOARD STUDENTS -

- Subject Name- MATHEMATICS
- Chapter Name- RELATIONS & FUNCTIONS

Lecture No.- 01

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Today's Targets

1. Glimpse of Class XI
2. Relation, Domain and Range of Relation
3. Types of Relation
4. Functions, Domain and Range
5. Types of Functions

NCERT Wallah

Sankalp Batch

Glimpse of Class XI

Cartesian Product of Sets

Ordered Pair of elements

$A \times B = \{(x, y): x \in A \ \& \ y \in B\}$

* $n(A \times B) = n(A) \times n(B)$
* $n(B \times A) = n(A) \times n(B)$
* $n(A \times B \times C) = n(A) \times n(B) \times n(C)$

* If $A = B$

$\Leftrightarrow$

$A \times B = B \times A$

When $A \neq B$

$\Rightarrow A \times B \neq B \times A$

Cartesian Product

Cardinality = No. of elements in a set

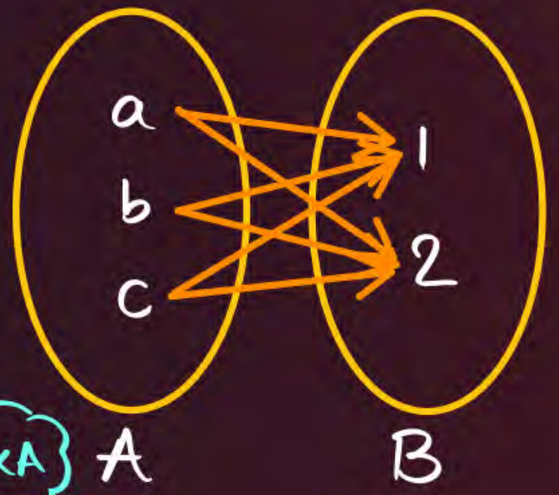
$A = \{a, b, c\}$ → $n(A) = 3$

$B = \{1, 2\}$ → $n(B) = 2$

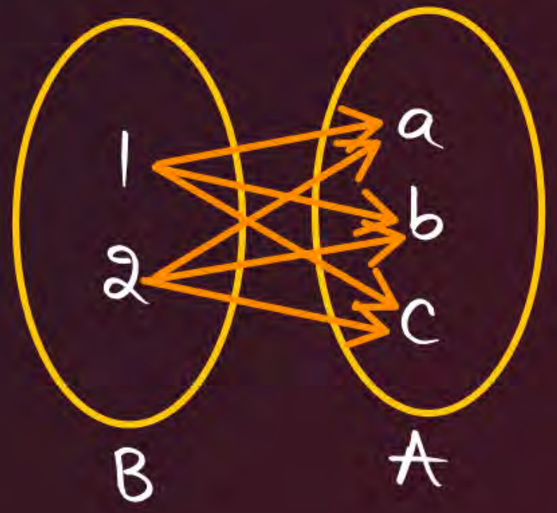
$A \times B = \{(a,1), (a,2), (b,1), (b,2), (c,1), (c,2)\}$

$B \times A = \{(1,a), (1,b), (1,c), (2,a), (2,b), (2,c)\}$

$A \times B \neq B \times A$



* $n(A \times B) = n(B \times A) = n(A) \times n(B) = 3 \times 2 = 6$



Definition

$A \times B = \{(x,y) : x \in A, y \in B\}$

$B \times A = \{(y,x) : x \in A, y \in B\}$

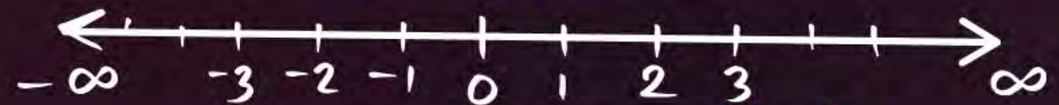
$A = \{1, 2\}$ $B = \{1, 2\}$

$A \times B = \{(1,1), (1,2), (2,1), (2,2)\}$

$B \times A = \{(1,1), (1,2), (2,1), (2,2)\}$

$A \times B = B \times A$

1-Dimension

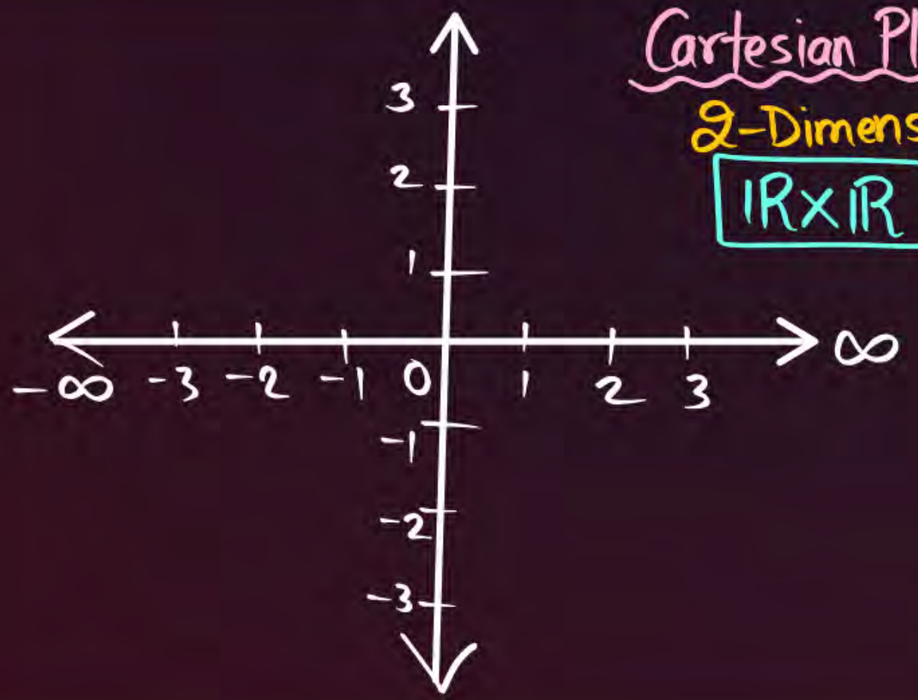


Real No. line ($\mathbb{R}$)

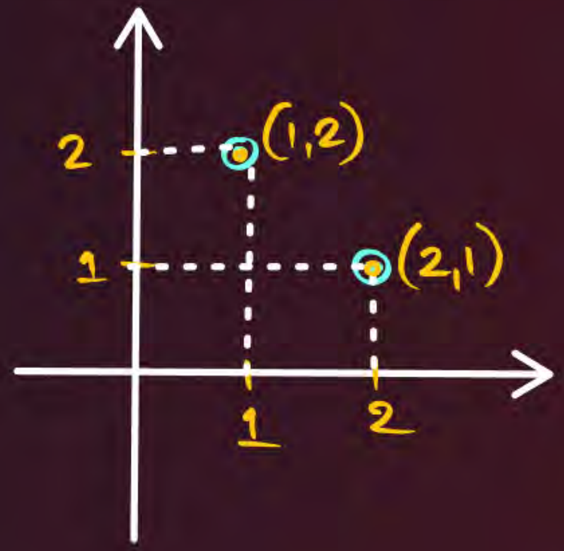
Cartesian Plane

2-Dimension

$\mathbb{R} \times \mathbb{R}$



$(1,2) \neq (2,1)$



Glimpse of Class XI

Relation

$R: A \to B$ is a subset of $A \times B$

$R \subseteq A \times B$

Binary Relation

$R: A \to A$ is a subset of $A \times A$

Universal Relation

$R: A \to B$ is a equal to $A \times B$

Empty Relation

$R: A \to B$ is a equal to ϕ

Domain, Co-domain & Range

$\text{Domain}_R = \{a: (a, b) \in R\} \subseteq A$

$\text{Range}_R = \{b: (a, b) \in R\} \subseteq B$

$\text{Co-domain}_R = B$

No. of Possible Relations (A to B) = $(2)^{mn}$

No. of Possible Relations (A to A) = $(2)^{m^2}$

$A = \{a, b\}$, $B = \{1, 2\}$

$A \times B = \{(a,1), (a,2), (b,1), (b,2)\}$

✱ Total No. of Relations = Total no. of subsets of $A \times B$ $= (2)^{n(A) \times n(B)}$

Possible Subsets (Total subsets $= (2)^4 = 16$)

✱ Manish Pandey

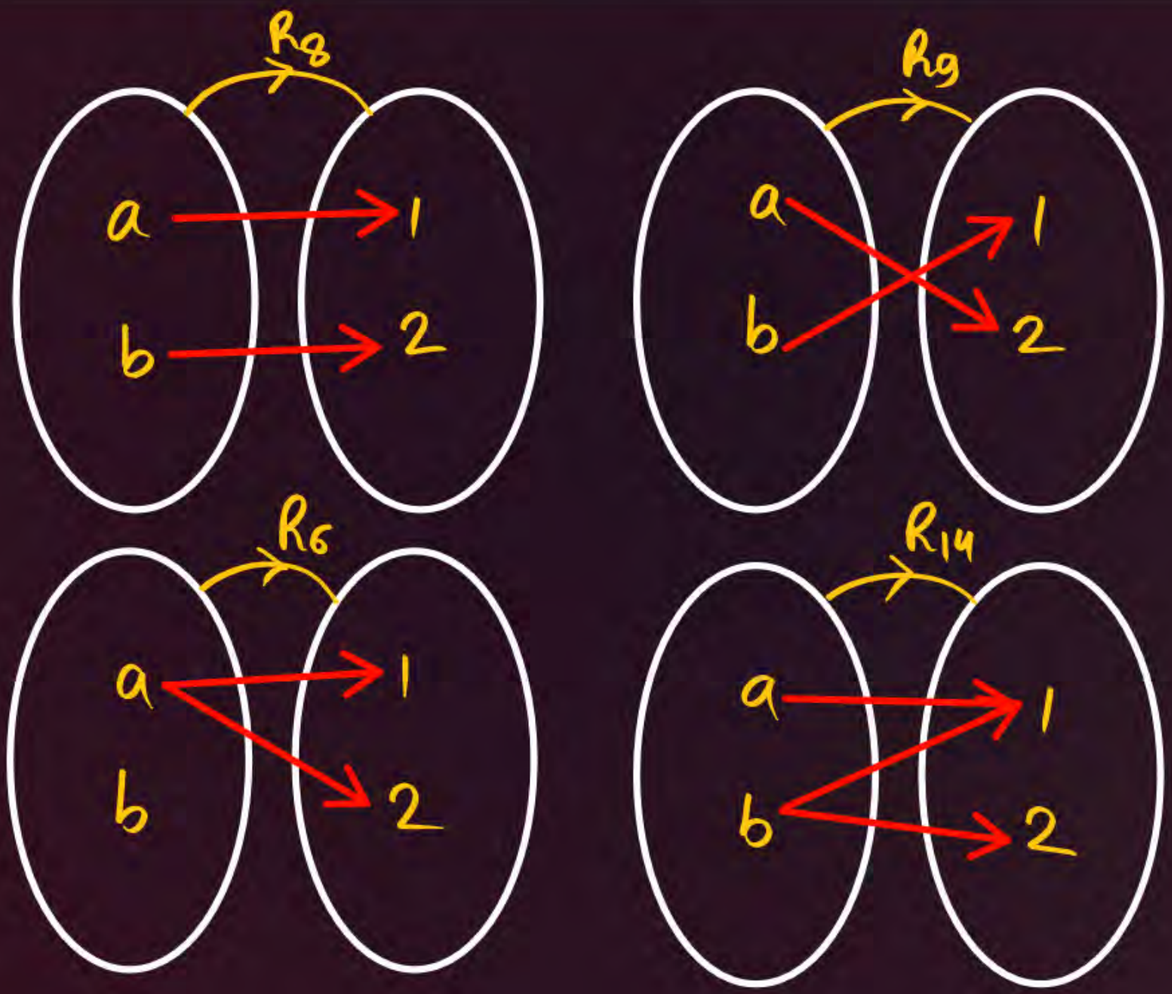
$R_1 = \phi$ → Empty Set

$R_2 = \{(a,1)\}$ $R_3 \to \{(a,2)\}$ $R_4 \to \{(b,1)\}$ $R_5 \to \{(b,2)\}$

$R_6 \to \{(a,1), (a,2)\}$ $R_7 \to \{(a,1), (b,1)\}$ $R_8 \to \{(a,1), (b,2)\}$, $R_9 \to \{(a,2), (b,1)\}$ $R_{10} \to \{(a,2), (b,2)\}$ $R_{11} \to \{(b,1), (b,2)\}$

$R_{12} \to \{(a,1), (a,2), (b,1)\}$ $R_{13} \to \{(a,1), (a,2), (b,2)\}$ $R_{14} \to \{(a,1), (b,1), (b,2)\}$ $R_{15} \to \{(a,2), (b,1), (b,2)\}$

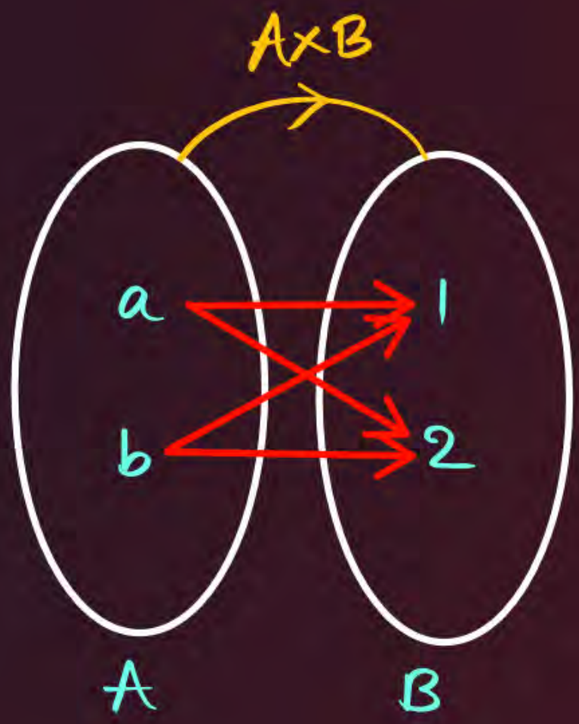
$R_{16} = \{(a,1), (a,2), (b,1), (b,2)\} = A \times B$


R_8
a
b
1
2

R_9
a
b
1
2

R_6
a
b
1
2

R_{14}
a
b
1
2


A×B
a
b
1
2
A
B

Najar hati durghatna ghati

$R = \{(a,b) : a = b+1 \ , a,b \in \{1,2,3,4,5\}\}$ (A) $= \{(2,1),(3,2),(4,3),(5,4)\}$

$R : A \to A$

a	b	R
$1 \in A$	$0 \notin A$	$(1,0) \notin R$
$2 \in A$	$1 \in A$	$(2,1) \in R$ ✓
$3 \in A$	$2 \in A$	$(3,2) \in R$ ✓
$4 \in A$	$3 \in A$	$(4,3) \in R$ ✓
$5 \in A$	$4 \in A$	$(5,4) \in R$ ✓

List of Ist elements → Domain $= \{2,3,4,5\}$

List of 2^{nd} elements → Range $= \{1,2,3,4\}$

$R : A \to B$ (B: Codomain)

(*) Range $\subseteq$ Co-domain

Codomain = 2nd Set $= A = \{1,2,3,4,5\}$

Question

If A has 3 elements then how many elements does $A \times A \times A$ has?

A 9

B 27

C 6

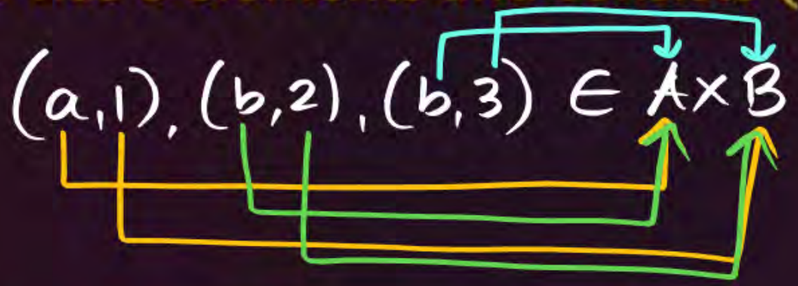
D None of these

$$n(A \times A \times A) = n(A) \times n(A) \times n(A)$$
$$= 3 \times 3 \times 3$$
$$= 27$$

Question

If $A \times B$ has 6 elements and consists $(a, 1), (b, 2)$ and $(b, 3)$ then find $B \times A$.

Sol:



$A = \{a, b\}$ $\quad$ $B = \{1, 2, 3\}$

$B \times A = \{(1,a), (1,b), (2,a), (2,b), (3,a), (3,b)\}$

Question

If $\begin{pmatrix} 3x+2 & 4y-1 \end{pmatrix} = \begin{pmatrix} 5 & 3 \end{pmatrix}$ then (x, y) is equal to:

A $(2,1)$

B $(1,2)$

C $(1,1)$

D None of these

$3x+2=5$ | $4y-1=3$

$x=\frac{3}{3}=1$ | $4y=4$

$x=1$ | $y=1$

$(x,y)=(1,1)$

Question

If $A = \{1, 2, 3\}$ and $B = \{a, b\}$ then how many non-empty proper subsets does $A \times B$ have?

A. 64

B. 63

C. 62

D. None of these

$A \times B = \{(1,a), (1,b), (2,a), (2,b), (3,a), (3,b)\}$

ϕ

$\{(1,a)\}, \{(1,b)\}$ _ _ _ _ .

$\{(1,a), (1,b)\}$ _ _ _ _ _

$\{(1,a), (1,b), (2,a)\}$ _ _ _

$\{(1,a), (1,b), (2,a), (2,b)\}$ _ _ _ .

$\{(1,a), (1,b), (2,a), (2,b), (3,a)\}$ _ _ _ .

~~$\{(1,a), (1,b), (2,a), (2,b), (3,a), (3,b)\}$~~

* Subset can be equal to set
* Proper subset can never be equal to set.

No. of subsets $= (2)^6 = 64$

No. of Non-empty proper subsets $= 64 - 2 = 62$

Question

Which of the following represents the relation given by $R: N \to N$ and defined by $R = \{(x, y): y = x^2, 0 \leq x, y \leq 10\}$

↗ Binary Relation

$0 \notin N$

A $\{(1,1), (2,4), (3,9), (4,16)\}$

B $\{(0,0), (1,1), (2,4), (3,9)\}$

C $\{(1,1), (2,4), (3,9), (4,16) \ldots (10,100)\}$

D $\{(1,1), (2,4), (3,9)\}$

x	y	R
$1 \in N$	$1 \in N$ ✓	$(1,1) \in R$
$2 \in N$	$4 \in N$ ✓	$(2,4) \in R$
$3 \in N$	$9 \in N$ ✓	$(3,9) \in R$
$4 \in N$	$16 \in N$ ×	—
$5 \in N$	$25 \in N$ ×	—
$6 \in N$	$36 \in N$ ×	—
$7 \in N$	$49 \in N$ ×	—
$8 \in N$	$64 \in N$ ×	—
$9 \in N$	$81 \in N$ ×	—
$10 \in N$	$100 \in N$ ×	—

Question

Let $R = \{(x, y) \mid y = x + \frac{1}{x}$ where $x, y \in N$ and $x < 6\}$. What is the range of the relation R?

x	y
1	$1+\frac{1}{1}=2 \in N$ ✓
2	$2+\frac{1}{2}=2.5 \notin N$ ✗
3	$3+\frac{1}{3}=3.33 \notin N$ ✗
4	$4+\frac{1}{4}=4.25 \notin N$ ✗
5	$5+\frac{1}{5}=5.2 \notin N$ ✗

$R = \{(1,2)\}$

Domain $= \{1\}$

Range $= \{2\}$

A. $\{1\}$ ✗

B. $\{1, 3, 5\}$ ✗

C. $\{1, 2, 3, 4, 5, 6\}$ ✗

D. None of these ✓

Question

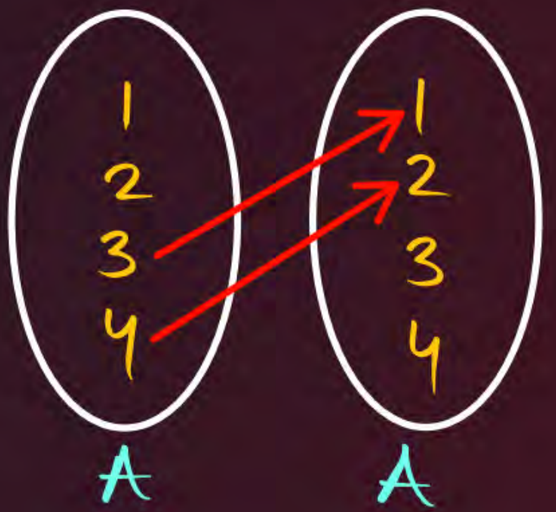
$R: A \to A$ (Binary Relation)

Determine the domain of the relation R on A defined by $R = \{(x+2, x): x \in A\}$ where $A = \{1,2,3,4\}$.

$x+2$	x
✓ $3 \in A$	1
✓ $4 \in A$	2
✗ $5 \notin A$	3
✗ $6 \notin A$	4

$R = \{(3,1), (4,2)\}$

Domain $= \{3,4\}$ Ans



Question

x related to y

Let R be a relation defined as xRy if and only if $2x + 3y = 20$ where $x, y \in N$. How many elements of the form (x, y) are there in R?

A 2

B 3

C 4

D 6

Homework

Homework

- Class XI (NCERT) ✓✓
- Exercise 2.1 and 2.2 (Revise)

THANK
YOU